VOL. 3 NO. 10 October 1986

COMPUTERDIGEST

A NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

OKIDATA UPGRADE

Breathing New Life Into An Old Workhorse

A GERNSBACK PUBLICATION

GRAPHIC BIOFEEDBACK MONITOR

Using Your Computer to Control Emotions

TVRO ANTENNA POINTER

Taking Out The Guesswork

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You can actually train yourself to be more composed and at peace. Using your computer, a color monitor and this device, it's easy.
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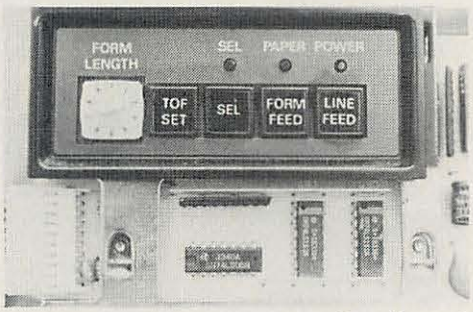

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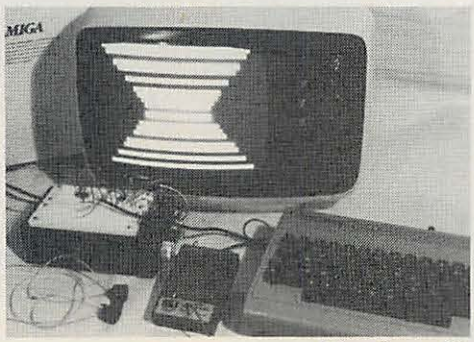

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ON THE COVER

That big, beautiful OKDATA® printer you see on our cover may be little more than a gleam in your eye, but until you can afford to replace the one you have, you can upgrade to get more and better performance. See page 12.

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COMING NEXT MONTH

We've got an absolutely dynamite issue coming up in November! We're kicking off with a story on streaming tape for computer backup, and following that with an easy-to-build protocol converter. Then we've got a handy-dandy program for helping design Schmitt triggers, and another program that gives you all the TV channel frequencies plus a lot more. And as a wrap-up, you'll find an excellent piece on retrofitting printers. Of course, we'll still have our Editorial, our Letters, and our Computer Products. It's going to be a winner, so don't miss it!

EDITORIAL

The changing face of computing

■At one time, a "memory" unit consisted of tiny ferrite beads strung on three wires. Today, things have advanced radically. And the room-sized computer that required a controlled temperature and raised floorboards has gone the way of the Reo, the Franklin, the Cord and the Tucker. Today's personal computer would appear to have reached a zenith, and the small "z" is intended.

But recently, we've seen advances in our own state-of-the-art technology that predict even greater things yet to come. Surface Acoustic Wave technology, optical disks, and advanced levels of miniaturization are aborning. If we could pull aside the veil, we'd see wonders as yet hidden and we can but speculate on what those might be.

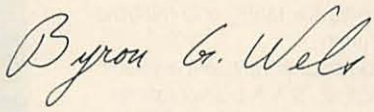
Tomorrow's computer miracles are already here. We've already got fluorescent flat screens, we've got bi-directional high-speed printers, and scientifically-designed keyboards that allow you to almost think with your fingers. And our computers operate faster than the human mind, and accept your input at a faster rate than you can type it in.

Which reveals almost instantly what the weakest link in computing is... It's us, the human element that slows computing from what it could be to what it is. Our next great advance in computing is to design a new type of human. We should have *four* eyes instead of just two. In that way, those of us that have to look at the keyboard while inputting would be able to keep two eyes on the keys and two eyes on the screen. And since the typical computer keyboard has 83 keys, we should develop hands with at least 42 fingers on each one. In that way, one finger could rest on a separate key and the need to move the fingers while typing would be obviated. Imagine how that would increase your speed!

While I'm on the subject, we should have an RS-232 jack at the backs of our skulls so we could do away with the monitor entirely. When you're plugged into your computer, all you'd be able to see would be the screen, and you'd be able to do it without using a separate monitor.

And finally, I want to build an illuminated sign for the top of my monitor, that when it hears the words "DINNER'S READY" it automatically lights up and says "IN A MINUTE!"

Yes, some great, new advances are coming in the world of computers. I just don't believe that I've outlined any of them.



Byron G. Wels
Editor

ComputerDigest is published monthly as an insert in Radio-Electronics magazine by Gernsback Publications, Inc., 500-B Bi-County Blvd., Farmingdale, N.Y. 11735. Second-Class Postage Paid at New York, N.Y. and additional mailing offices. Copyright © 1986 Gernsback Publications, Inc. All rights reserved. Printed in U.S.A.

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ADVERTISING SALES 516-293-3000
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LETTERS

The Cost of Change

I bought a new computer and find that my old serial printer won't work with it. An interface would cost almost as much as a used parallel printer. Could any of your readers use my old printer? It's letter quality, and I'd like to get a hundred bucks plus shipping costs.—P.T., Trenton, NJ.

We never meant the Letters Column to be "swap shop," but we're willing to help out.

Errors

Whenever I want to build a project in a magazine, I always wait a couple of months to see if there are going to be any corrections. Considering the number of projects you publish, there are relatively few mistakes! — R. S., Sioux Falls, SD.

Thank you! We thought we made a mistake once, but we were wrong!

Help!

I'm desparately looking for a program called "Computer Novel Construction Set" from Hayden Software. It's no longer being produced, and I'm willing to pay for it, or a copy of it. Can anybody help me?—L.S., Massapequa, NY.

If you can help, write to **ComputerDigest.**

Caveat Emptor!

If I buy a piece of computer equipment am I better off to buy something expensive or something far-less costly and upgrade it by putting in add-ons? I am a capable electronics technician but was wondering about the economics.—F.L., Ft. Lauderdale, FL.

It's hard to say. Usually we advise people to buy the best they can afford, thereby making their first expense their last. But if you construct your own, work carefully and install with equal care, you have the advantage of choosing your own times and costs.

Wants A Book

I read in a recent editorial that **ComputerDigest** is now three years old. Are you planning a book of "The Best Articles?"—R.S., Atlanta, GA.

Not yet.

Goof-Off

I'm trying to stall a science project for school and told the teacher I had written to you for information. So what's the value of a resistor with three red bands?—M.P., Portland, RI.

2.2K. Now get to work.

COMPUTER PRODUCTS

For more details use the free information card inside the back cover

LINE CONDITIONER, features a surge-protected RJ-11 data link, in addition to a plug-in AC power-surge suppressor, protecting sensitive electronics equipment against voltage spikes and surges, as well as virtually eliminating common-and-normal-

CIRCLE 18 ON FREE INFORMATION CARD

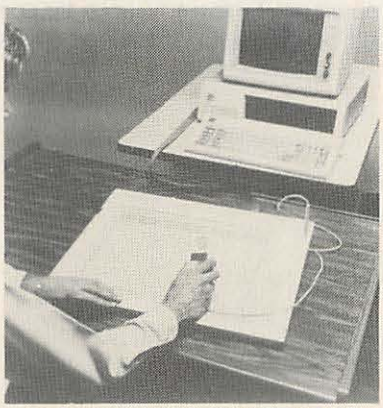
mode noise. There is a noise rejection of 130 dB common-mode and 80 dB normal-mode.

A field-replaceable power-line surge arrestor is plugged into the unit and isolates itself if damaged by high-energy strikes. An LED status light continuously monitors its condition. The unit features better than 95% efficiency, potential to handle inrush current up to 10x rating, and multiple service outlets.

Line-conditioner units are available in 500VA, 1, 2, 3k VA power ratings, with end-user prices ranging from $395.00 to $935.00.—**Displex, Inc.,** 1 Alexander Place, Glen Cove, NY 11542.

GRAPHIC TABLET, the model *GT 1510,* is compatible with every personal computer available today; it interfaces easily with PC's when it is used in conjunction with CAD software.

Included with the model *GT 1510* are a pen and puck. It is the only tablet to offer the following as standard features: a relegendable menu-strip area with strips for AUOTCAD and blank for customized CAD instructions. In additon, it comes with a power supply and all cable connections.



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The model *GT 1510* Graphic Tablet, complete with cursor puck and pen, is priced at $795.00.—**Cherry Electrical Products Corporation,** 3600 Sunset Avenue, Waukegan, IL 60087.

SOFTWARE REVIEW

How to back up a protected disk...

■As long as there were newcomers to personal computing the distributors of the most popular programs justified the prices for their software by the myth of *software pirates*, who made millions of unpaid for and unauthorized copies. Although it was the best of times for software sales—creating multimillionaires overnight—the distributors went to great lengths to prevent unauthorized backups, "unauthorized" meaning a backup for the user who might have just plunked down $300 to $500 for the program. Now, software sales are tough to come by. There are at least five decent versions of every kind of program, and with competition much of the top-selling software is now available in unprotected versions. Meanwhile, thousands of users are stuck with unbackable software, dreading the day when the "original" disk actually wears out (yes, oxide wears), while those who have converted to hard disk find the protected software won't run on a hard disk at all, or requires a "key" disk to be in drive A:. (Requiring a key disk eliminates the advantage of a hard disk, as well as wearing the unbackable original.) Either way, the protected programs provide limited use, and the distributors won't swap the protected software for the unprotected version.

A low-cost solution to the problem of older, protected software is a program called COPYIIPC, which can back up either protected disks or protected working disks, or it can bypass hard disk restrictions. A *protected working disk* is an uncopyable working disk that was created from the distribution (original) program disk by an *install* program. Either the working. copy contains the DOS and is self-booting (but cannot be backed up), or it does not contain the DOS and must be used in Drive B: while the original distribution disk in Drive A: functions as a *key*. Often, the install program permits an extra backup working disk to be made from the original, but the original disk cannot be run by itself.

There are two kinds of hard disk restrictions. One precludes the program running from a hard disk even if the user can copy it to the hard disk. The other requires the distribution disk to be in Drive A: as the "key." If your computer has the usual one floppy and hard disk configuration, it's obvious that you can't write to a floppy data disk.

COPYIIPC which resolves the problems, consists of six utilities. Only four are used for making backups and by-passing hard disk restrictions. One of the others is a SETUP program which installs DOS on the disk so it can be made self-booting. (But the DOS must be an unmodified version.) The other is BULKERAS which electronically wipes a disk by destroying all data, leaving only the track formatting.

The backup utilities consist of the main COPYIIPC program itself, a special version for the IBM-PC-Jr., NOGARD, which backs up software that resists the normal COPYIIPC backup procedure, and NOKEY, which is loaded into RAM prior to a program from a hard disk and eliminates the need for a "key" disk in Drive A:.

COPYIIPC needs a minimum of 64K RAM but it will use all available memory to speed things. It will back up either single or double sided disks as written. It's equal to the DOS's DISCOPY and DISCOMP utilities combined. The COPYIIPC program also tests the speed of the disk drives used for making backups because even with the drives running at the normal tolerance of 200 rpm backups should be made from the faster drive to the slower (you can run out of disk space if copying from a slower to a faster drive). While the easiest procedure uses two drives, backups can be made using one drive by following the screen prompts on when to swap disks.

COPYIIPC cannot make a functional backup of certain programs. although it might appear the backup is successful the program won't run from the copy. However, it will usually indicate this problem and prompt for the user to run the NOGUARD utility, which uses both the original distribution disk and the non-functional backup to create a functional unprotected copy that can even be installed on a hard disk.

Users of hard disks having several hundred dollars invested in software that won't run unless the original distribution disk is installed in drive A: as a "key" will find the most valuable feature of COPYIIPC to be the NOKEY utility, which is loaded into RAM just before the main program. NOKEY "tricks" the restricted program into believing the key disk really is in drive A:. Drive A: cycles once and as far as the hard disk is concerned the key disk really is in drive A:. However, drive A: is empty and available for a data disk, a disk file source, or whatever.

Although COPYIIPC backs up the distribution disk and frees the hard disk restrictions of many commonly-used programs, it doesn't work for everything.; at least that's what's implied in the documentation. (Since our collection of software is more or less conventional, everything we tried could be backed up or used on a hard disk.) Central Point Software supplies a long list of some 150 popular programs with which users have reported success using COPYIIPC. If you have software that isn't on the list the best thing to do is phone the distributor direct at (503) 244-5782.

COPYIIPC is available for $39.95 (plus $3.00 shipping and handling) direct from Central Point Software, Inc., 9700 SW Capitol Highway, #100, Portland, OR 97219. It runs on the IBM PC, XT, AT and PCjr., the Compaq, the Columbia, the Corona, and some other very compatible compatibles. If you're not certain it will run on your computer, call the distributor before you buy.

◀CD▶

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GRAPHIC BIOFEEDBACK MONITOR

Here's a simple and interesting experiment...

Ronald A. Peterson

■Biofeedback is a fascinating area of exploration in that it allows you to mechanically produce a physical reaction that is associated with a change in your thoughts. Perhaps some of the fascination comes from the possibility that with a subtle enough device one could draw a line on a computer screen or direct a robot to move an object. Such an advance would give us the ultimate in remote control and would provide an end to many excuses for not doing things, since the thought would be sufficient to trigger the action.

This article describes the interfacing of a simple biofeedback device to a Commodore 64 computer to provide a graphic display of your state of mental relaxation. The most easily measured property of your body which can be linked to changes in state of mind

```
1 REM---BIOFEEDBACK ROUTINES
2 REM---RE DECEMBER 5,1985
3 REM--- RONALD PETERSON
10 REM---LOAD MACHINE ROUTINES
20 FOR I=4096 TO 4165
30 READ A:POKEI,A:CK=CK+A
40 NEXT I
50 FOR I=12288 TO 12386
60 READ A:POKEI,A:CK=CK+A
70 NEXT I
80 FOR I=12544 TO 12557
90 READ A:POKEI,A:CK=CK+A
100 NEXT I
110 IF CK=22442 THEN 120
115 PRINT"ERROR IN DATA STATEMENTS"
116 STOP
120 REM---SET FREQUENCY
130 SYS4096
140 PRINTPEEK(8192)+256*PEEK(8193)
150 FORI=1TO100:NEXT
160 PRINT "□SET TO 50-->";
170 GETA$:IFA$<>"" THEN 200
180 GOTO130
190 REM---CLEAR SCREEN
200 POKE53280,0:POKE53281,0
210 FOR I=1024 TO 2023
215 POKEI,160:NEXT I
220 FOR I=55296 TO 56295
225 POKEI,0:NEXT I
230 REM---UPDATE GRAPHICS
240 SYS4096
250 Q=PEEK(8192)+256*PEEK(8193)
260 CL=CL+1:CL=CLAND15:POKE12434,CL
270 FOR J=1 TO 3*Q:NEXT
280 SYS12288
290 GOTO 240
295 REM---READ JOYSTICK PORT
300 DATA  120 , 169 , 0 , 141
310 DATA  0 , 32 , 141 , 1
320 DATA  32 , 173 , 0 , 220
330 DATA  41 , 1 , 240 , 249
340 DATA  173 , 0 , 220 , 41
350 DATA  1 , 208 , 249 , 32
360 DATA  64 , 16 , 173 , 0
370 DATA  220 , 41 , 1 , 240
380 DATA  246 , 32 , 64 , 16
390 DATA  173 , 0 , 220 , 41
400 DATA  1 , 208 , 246 , 88
410 DATA  96 , 173 , 0 , 32
420 DATA  24 , 105 , 1 , 141
430 DATA  0 , 32 , 173 , 1
440 DATA  32 , 105 , 0 , 141
450 DATA  1 , 32 , 173 , 0
460 DATA  220 , 41 , 1 , 240
470 DATA  232 , 96
480 REM---DISPLAY ROUTINES
490 DATA  169 , 0 , 133 , 251
500 DATA  169 , 216 , 133 , 252
510 DATA  169 , 0 , 141 , 144
520 DATA  48 , 169 , 40 , 141
530 DATA  145 , 48 , 162 , 12
540 DATA  173 , 146 , 48 , 172
550 DATA  144 , 48 , 234 , 234
560 DATA  145 , 251 , 234 , 200
570 DATA  204 , 145 , 48 , 208
580 DATA  247 , 32 , 0 , 49
590 DATA  238 , 146 , 48 , 238
600 DATA  144 , 48 , 206 , 145
610 DATA  48 , 202 , 16 , 224
620 DATA  234 , 234 , 234 , 206
630 DATA  144 , 48 , 206 , 144
640 DATA  48 , 238 , 145 , 48
650 DATA  238 , 145 , 48 , 162
660 DATA  12 , 173 , 146 , 48
670 DATA  172 , 144 , 48 , 145
680 DATA  251 , 200 , 204 , 145
690 DATA  48 , 208 , 248 , 32
700 DATA  0 , 49 , 238 , 146
710 DATA  48 , 206 , 144 , 48
720 DATA  238 , 145 , 48 , 202
730 DATA  16 , 227 , 96
740 REM---SUBROUTINE
750 DATA  165 , 251 , 24 , 105
760 DATA  40 , 133 , 251 , 165
770 DATA  252 , 105 , 0 , 133
780 DATA  252 , 96
```

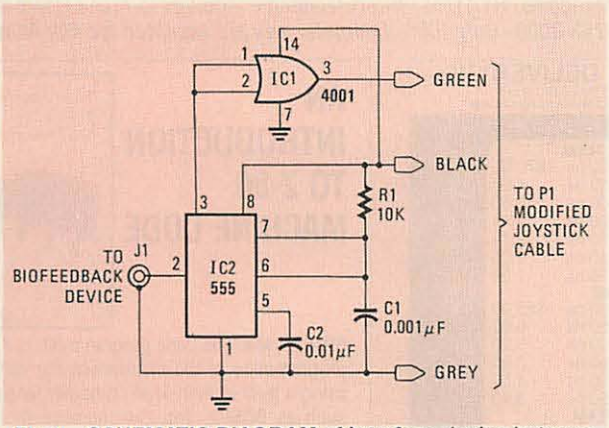
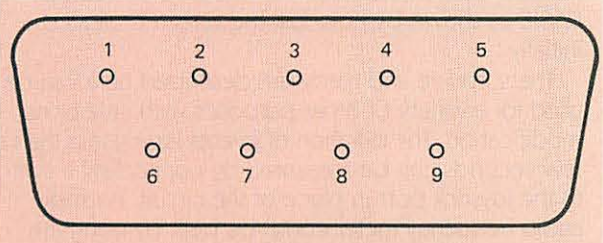


Fig. 1—SCHEMATIC DIAGRAM of interface device between joystick port and the biofeedback monitoring device.

is the resistance of your skin. To measure skin resistance we will use a biofeedback device made by Radio Shack (catalog #63-675, $12.95) The output of this device will be connected through a simple interface circuit to the joystick port on the computer and used to control the speed at which a graphic pattern changes.

To begin, build the circuit shown in figure 1. Since circuit speed is not a problem and there are no dangerous voltages, the construction technique is not critical. Building the circuit on perfboard or an experimenters socket is fine. A 1/8-inch miniature phone plug is used to connect the earplug output from the biofeedback device to the circuit. A joystick extension cable is modified by cutting off the end that goes to the joystick in order to connect the circuit to the computer's joystick port. Pay attention to the color coding of the modified cable. (See figure 2.) Improper wiring could short out the five volt power supply in your computer, destroying it!

Next type the program into the computer and Save It BEFORE running it. Since the program uses machine code routines, any error in typing it in could cause the computer to hang up, thus making it necessary to type the program in again. When you run the program the machine code will be loaded into memory and



Pin	Color	Type
1	Green	Joy Up
2	Yellow	Joy Down
3	Orange	Joy Left
4	Red	Joy Right
5	Brown	Pot DY
6	Blue	Fire Button
7	Black	+5Vdc
8	Grey	Ground
9	White	Pot AX

Fig. 2—JOYSTICK PORT pinout diagram for the Commodore. Refer to the text for further clarification.

automatically checked. Examine the DATA statements if an error occurs when it is run. The program can be tested by connecting a joystick to port 2 and running the program while moving the joystick up and down. A message will appear with a number next to it while you move the joystick. Keep moving the stick and hit the space bar on the computer. After a few moments the screen will clear and a graphic pattern will appear. If you do not get the pattern then something is wrong and you should check the program for typing errors.

To make it all work together, first load the program and run it. Then plug the biofeedback device into the circuit and connect the circuit to joystick port 2 on the computer. Next you need to set the frequency of the oscillator in the biofeedback device. It will not oscillate unless it is connected to something so attach it to your fingers and then turn it on and adjust its pitch control until the number next to the message on the computer screen begins to change. When you have a reading in the 50 to 200 range, hold down the space bar to activate the display. The screen will clear and a moving pattern will appear. Then sit back and relax! The speed with which the pattern changes should now alter depending on how relaxed you are. Since the device is sensitive to changes in skin resistance be careful not to move the hand with the electrodes attached to it or you will alter the pattern speed.

How it works

When you are relaxed your breathing slows, your heart slows down and your muscles loosen up. In this state your body doesn't need to burn as much fuel to keep going, and so with the furnaces damped down there is less oil, water and other wastes expelled through your skin. This causes a change in the resistance of your skin and it is this change that can be measured and fed back to your senses with the proper device.

Radio Shack's biofeedback device is essentially a variable frequency pulse generator where the frequency is controlled by resistance. A small current is fed through your skin, amplified, and then used to control the oscillator. The pulse output from the oscillator is fairly sloppy however so it has to be cleaned up before being sent to the computer. The 555 timer is configured as a monostable multivibrator (one-shot flip-flop) to extend the duration of the pulses which are then fed to an inverter made from a NOR gate to further square them up. Power for the circuit is provided by a +5Vdc line from the joystick port. The output of the inverter is fed to a pin on this port which is usually connected to the UP switch on a joystick. Thus each pulse from the biofeedback device is made to look to the computer like a joystick switch opening and closing.

The software contains three fundamental parts. The first is a BASIC routine which provides master control. The second is a machine language subroutine that reads the joystick port and counts the time between pulses. Lines 140 and 250 in the BASIC program read this count from where it is stored in RAM. The third is another machine language routine that draws the colored pattern on the screen. Line 260 in the BASIC

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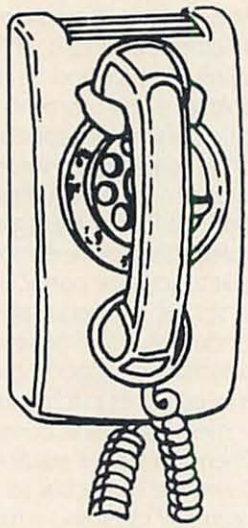

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program sets the starting color for the pattern every time it is redrawn. Machine language is used here for speed. The pulses from the biofeedback device are at audio frequencies and BASIC is far too slow to count the length of time between pulses. Changing all the colored bars on the screen would also be too slow in BASIC as shown by how fast the screen is cleared initially.

The software and hardware described here can be used for a variety of other purposes with little or no modification. The duration of events lasting less than a few seconds can be measured by connecting a switch to the joystick port in place of the circuit. A crude audio frequency meter could be built by using the machine code routine to measure the duration of one cycle. (A comparator and amplifier will probably be needed to square up and increase gain of the signal.) The code could also be modified to read the other joystick switch connections in order to sense several events simultaneously. (The lowest four bits at memory location 56320 represent the four joystick positions. The fifth bit is the fire button.) Experiment with it! Maybe you'll be the first to build a thought-controlled robot!◀CD▶

PARTS LIST

Semiconductors
IC1—4001 quad NOR gate
IC2—555 timer

Resistor
R1—10,000 ohms, ¼ watt, 5%

Capacitors
C1—.001µF., ceramic
C2—.01µF., ceramic

Miscellaneous
J1—Miniature phone plug
P1—Modified joystick extension cable (see text)
BF1—Biofeedback monitor (Radio Shack #63-675)
Wire, perfboard, solder, etc.

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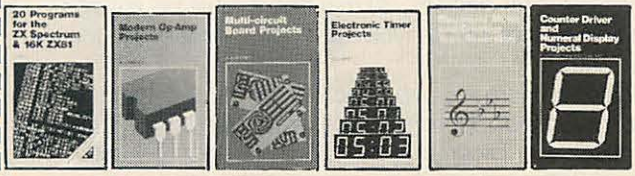
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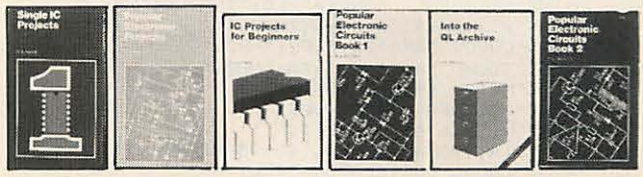
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TVRO ANTENNA POINTER

Let your computer nail those satellites!

Elery C. Smith, Jr.

■Okay, you've got a computer and you're into Satellite reception for your TV. The program offered here will help you in aiming your dish right on the money, and we're even going to give you a way to check and make sure that everything's working right.

The TVRO Antenna Pointing program is written in BASIC and can easily be programmed into almost any computer. All your entries must be in decimal. If your longitude is 95 degrees, 30 minutes, it must be entered as 95.5. And of course, you must not reverse longitude and latitude.

Included here are two typical samples of entries, one for Orlando. Florida, the other for Huntsville, Texas. To check your program once it's installed, simply enter my numbers and see if you come up with the same answers. It's that easy.

There's one other thing. Most computers calculate angles using radians. The .01745329 changes your "degrees" entry to radians and back to degrees again. If your computer compensates for a direct entry, simply leave the .01745329 out of the program.◀Ⓓ▶

```
10 PRINT"TV CHANNEL FREQUENCY DIRECTORY"
20 PRINT"**********************"
30 INPUT"TV CHANNEL ";A$
40 A=ASC(A$):IFA>64THEN300
50 C=VAL(A$)
100 IFC<2THEN600
110 IFC<5THEN200
120 IFC<7THEN190
130 IFC<14THEN180
140 INPUT"UHF OR CABLE ";B$
150 IF LEFT$(B$,1)="C"THEN320
160 IFC>83THEN600
170 BC=14:BF=470:GOTO400
10 BC=7:BF=174:GOTO4 BC=5:BF=76:GOTO400
200 BC=2:BF=54:GOTO400
300 IFA>90THEN600
310 C=A-51:PRINTA$;" =CABLE CH# ";C
320 IFC>65THEN600
330 IFC<23THENPRINT"MID BAND CHANNEL":GOTO360
340 PRINT"SUPER BAND CHANNEL"
350 BC=23:BF=216:GOTO400
360 BC=14:BF=120
400 LB=BF+(C-BC)*6
410 UB=LB+6
420 FV=LB+1.25:FC=FV+3.58:FA=FV+4.5
430 FL=LB+47
440 IL=UB+41*2:IU=LB+47*2
450 PRINT"FREQUENCY RANGE=";LB;"TO";UB;"MHZ."
460 PRINT"PIX CARRIER=";FV;"MHZ."
470 PRINT"COLOR CARRIER=";FC;"MHZ."
480 PRINT"SOUND CARRIER=";FA;"MHZ."
490 PRINT"NOTE: THE FOLLOWING"
500 PRINT"ASSUMES A RECEIVER"
510 PRINT"WITH A 41-47MHZ I.F."
515 PRINT"(41.25MHZ SOUND, 45.75MHZ PIX.)"
520 PRINT"LOCAL OSCILLATOR=";FL;"MHZ."
540 PRINT"IMAGE RANGE=";IL;"TO";IU;"MHZ."
550 PRINT"MORE?"
560 GETC$:IFC$=""THEN560
570 PRINTC$:IFC$="Y"THEN20
580 END
600 PRINT"NON-EXISTENT CHANNEL":GOTO20
```

PROGRAM LISTING ABOVE is written in BASIC and lets you use almost any computer to help aim your satellite antenna.

```
TV CHANNEL?
36
UHF OR CABLE?
CABLE
SUPER BAND CHANNEL
FREQUENCY RANGE= 294 TO 300 MHZ.
PIX CARRIER= 295.25 MHZ.
COLOR CARRIER= 298.83 MHZ.
SOUND CARRIER= 299.75 MHZ.
NOTE: THE FOLLOWING
ASSUMES A RECEIVER
WITH A 41-47MHZ I.F.
(41.25MHZ SOUND, 45.75MHZ PIX.)
LOCAL OSCILLATOR= 341 MHZ.
IMAGE RANGE= 382 TO 388 MHZ.
MORE?
Y
**********************
TV CHANNEL?
W
W =CABLE CH#  36
SUPER BAND CHANNEL
FREQUENCY RANGE= 294 TO 300 MHZ.
PIX CARRIER= 295.25 MHZ.
COLOR CARRIER= 298.83 MHZ.
SOUND CARRIER= 299.75 MHZ.
NOTE: THE FOLLOWING
ASSUMES A RECEIVER
WITH A 41-47MHZ I.F.
(41.25MHZ SOUND, 45.75MHZ PIX.)
LOCAL OSCILLATOR= 341 MHZ.
IMAGE RANGE= 382 TO 388 MHZ.
MORE?
N
```

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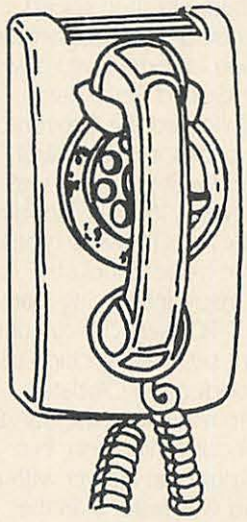

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OKIDATA UPGRADE

How to get more out of your Okidata— Without putting a lot more into it...

Elliott S. Kanter

■The Okidata Models 82 and 83A have for years been a part of many home and business computer systems. Their reasonable cost and good reliability and speed have made them a staple for the medium- or small-volume printer user who was willing to put up with inconvenience in exchange for the durability and reliability usually associated with an army tank.

One of the minor inconveniences present with both printers, which only vary in column width capability (82A-80 col., 83A-132 Col.) is clearly shown in Table 1, an actual print sample of the rather limited selection of (4) type sizes. However, to further complicate this limitation, there was no easy way other than writing a simple BASIC program with an appropriate "LPRINT" command to change these type sizes, unless you went to the trouble of customizing your wordprocessing program and convert these command codes to others which a program such as WordStar™ could recognize. As if to placate those users of the Okidata line, the company included some values/benefits which were not present on other printers. Okidata 82A and 83A supported your choice of either serial or parallel ports, to a degree. The serial port had a built-in speed limitation of 1200 baud and could only support certain protocols without the addition (at extra cost) of what Okidata referred to as a High-Speed Serial Card. Essentially, the parallel port followed the Centronics conventions, but the printer codes, those control sequences which determined what type size was selected, *i.e.* 10 CPI (normal type), 16.5 CPI (condensed type), 8.3 CPI (expanded type) or CPI (wide type) were not compatible with the defacto industry standard Epson codes. This made interfacing many of the features available to IBM™ PC users difficult unless you purchased a replacement set of ROM chips called the "Plug 'N Play" option or added the Okidata OKIGRAPH option. You had to really love the 82A/83A to put up with these minor inconveniences—but considering the fact that it would run forever with a change or two of ribbon, and was faster than the Epson competition, the printers found their way into many computer applications.

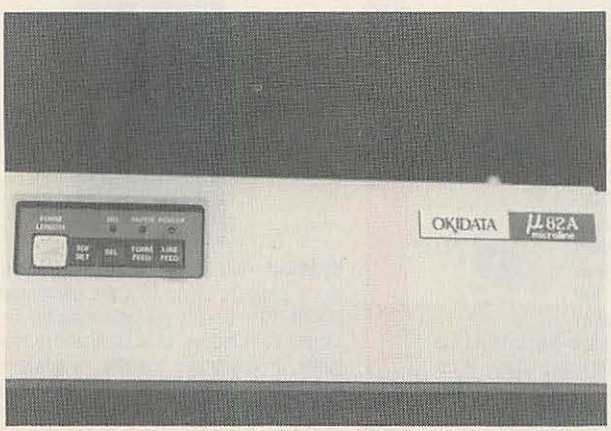

Fig. 1—Front view and orientation of the Okidata ML 82A Printer.

While offering two options to enhance the ability of the Okidata Printers to respond (much in the same fashion) as the IBM Graphics or Epson MX-80/MX-100 printers, not much else was done to improve upon the printing quality except perhaps by some diehards with the expertise to write custom programs and make the printers do other and somewhat better printing jobs. Yet at the same time there were aftermarket products available for the Epson products which permitted alternative type styles, sizes and even near letter-quality at fairly reasonable cost adding in the neighborhood of about $130.00 to the basic cost of the printer. When the Okidata owners called or wrote these companies whose ads said "...enhances dot-matrix printers....offers near letter quality...etc." they found out, sorry, but we only support the Epson and true-Epson compatible printers, we have no plans to support the Okidata

products. This remained true until a Costa Mesa and now Irvine, California Company called Rainbow Technologies Inc., introduced the first in a series of enhancements for the Okidata printers. The original or parent product, OK-Writer™ added near letter quality, dot addressable graphics and other features to the printer via a PC card which replaced the existing three ROM chips, it also expanded the speed of the built-in serial port from its 1200 baud limitation to 2400 baud and provided some other goodies which were front panel selectable and didn't require any skills in computer programming.

Progress, like time, stands still for no person, company or computer and Rainbow Technologies built its second generation product, the PC-writer™, incorporating many of the features of the OK-Writer and adding just a few more enhancements like:

* Pica, elite or compressed type styles
* Double width characters in any type style
* Draft (DQ 120CPS) or Near Letter Quality (LQ 30 CPS)
* Ability to print all IBM printer symbols
* Ability to print double line box drawing symbols
* Backspace for easy overstriking

The items listed above can't really do the PC-Writer as much justice as the print sample of the self-test. This actual print sample is the result of the built in self-test activated from the front panel in much the same manner (pressing and holding the LINE FEED button while turning the power ON) as the conventional and unmodified self-test runs on the 82A/83A. However the results and printout are outstanding.

In order to gain some things you sacrifice others. In the case of near letter quality, the PC-Writer, like its competition, the super-enhanced Epsons will not operate at the nominal 120 CPS, but will slow to around 30 CPS, however, because near letter quality requires multiple passes, there's always a chance of a higher noise level due to vibration. In the case of the PC-Writer, this problem is minimized by converting the horizontal emphasis commands into vertical emphasis or double strike commands.

To make any dot-matrix printer's output more closely resemble near letter or letter-quality, the dots formed by the print head must be made to form a denser pattern. This is accomplished by multiple-passes and results in a decrease in speed. However, these usual techniques do not allow for all of the type fonts available with PC-Writer, and are the result of creative approaches to command code programming in order to make a printer whose average retail price (my area) was about $239.00 plus the PC-Writer (at a suggested list price of $112.95) perform like a letter quality printer selling for double its price! One catch, you have to be handy enough to install the small circuit board yourself.

```
Sample Printouts for Unmodified Okidata 82A

THIS IS A SAMPLE OF CONDENSED 16.5 CPI TEXT

THIS LINE RETURNS YOU TO NORMAL

EXPANDED 8.3CPI TEXT

RETURN TO NORMAL 10 CPI

WIDE 5CPI SAMPLE TEXT
RETURN TO NORMAL
```

Sample print out unmodified Okidata ML 82A printer. All print styles were accessed via "LPRINT" commands.

For those of you who read and followed my articles in the July and August issues of Radio Electronics and built your own compatible PC/XT's what comes next will be a piece of cake. If you haven't worked on any electronics devices, the instructions and illustrations that follow will make the conversion seem easy enough to follow. A note of caution to either group of installer/builders, once the cover of your printer has been removed, there is a potential for accidental electric shock. Before proceeding any further, unplug your printer from the AC wall outlet and disconnect the cable leading to your computer.

You will need the following hand tools to accomplish the modification: Phillips Head screwdriver with at least a 4-inch shaft, IC Puller (Radio Shack) or small flat-bladed screwdriver.

These items are desireable, but not essential to the modification: Anti-static wrist bracelet, Diagonal Cutters, or A length of hookup wire, a 25K ohm (or greater) resistor and two alligator clips.

Warning

The PC-Writer circuit board module can be damaged by static electricity. Do not remove it from its protective packaging until you are ready to install it in your printer.

INSTALLATION

After you unplug your printer from the wall and computer, position it as shown in Figure 1. As you view the printer from the front, you will see to your right, a large black plastic knob coming out of the right side of the case. This knob is the platen knob and must be removed before we can proceed. Remove this knob by gently pulling it off and set it aside.

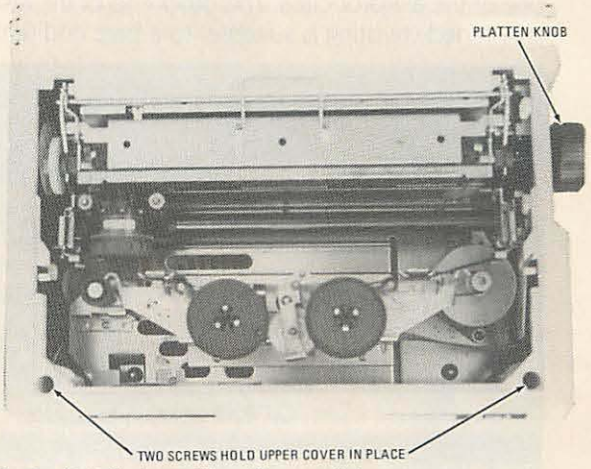

Fig. 2—Detail view with call outs of the upper cover showing the two screws which must be removed as well as the platten knob.

Remove the access cover by gently lifting it up and set it aside.

Refer to Figure 2 and loosen the two recessed phillips head screws which hold the front upper cover in place. Remove the cover by lifting it up and pushing it back to release the hooks located on the back panel of the printer. Carefully set the cover aside, taking the necessary precautions to avoid losing the two screws.

Turn your printer around as shown in Figure 3 and locate the control circuit board. It is normally located in the first slot from the rear unless you have the optional high speed serial card. If you have the high speed serial card installed, you will have to remove this card before going any further. If you have the high speed serial card, locate the two hold-down screws one at each side of the circuit board and carefully remove the board to enable you to access the control circuit board.

If you do not have the high speed serial card installed, loosen the two hold-down screws at either end of the control circuit board and carefully lift it up until you can identify the three large ICs located at the top right hand corner (as viewed from the rear) and shown in Figures 4. Using either the small flat bladed screw driver or the IC puller, remove these three 24-pin ICs by gently prying them loose from their sockets. The ICs are numbered 004, 005 and 006. You may have to remove cable CN5 from its socket on the control board in order to access these 3 ICs. Once you have removed the ICs you may put them aside, they will not be required when you install the PC-Writer module. Before proceeding with the installation, check that capacitors C27, C28 and C29 are at approximately a 60 degree angle relative to the control circuit board, if they are not, bend them as required. Check to see that capacitor C28 is at approximately a 90-degree angle and correct if need by bending. This will facilitate the installation of the PC-Writer Module.

If you have the anti-static bracelet, place it around your wrist and connect the alligator clip at the end of the wire to a suitable ground connection. If you are wearing a metal watch band, you can use the wire, resistor and two alligator clips to form a similar protective device. Connect one end of the resistor to one of the alligator clips. The other end of the resistor is fastened (twisting is suitable) to a bare end (either end of the wire), the remaining alligator clip should be attached to the end of the wire and connected to a suitable ground connection. The reason for these anti-static precautions is to eliminate the chance that static electric discharges could damage the PC-Writer module. Now you may open the PC-Writer container and carefully remove the module. Refer to Figure 5, the PC-Writer and locate it with the arrows pointing upwards and the circuit components facing you. If you are installing the PC-Writer in an Okidata 83A, locate resistor B labeled "CUT FOR ML83A." Using a diagonal cutter, carefully cut the wires attaching this resistor to the circuit board and discard the resistor. Carefully remove the protective foam from the underside of the circuit board, and observe the pins extending from the non-component side.

Align these pins with the corresponding locations of sockets 004 and 006 on the circuit control card. Gently press the module into these two sockets and continue the pressure until all pins have been seated in the sockets. Your PC-Writer does not use socket 005. Check your work and ensure that all pins are firmly seated as shown in Figure 6. If you had to remove cable CN5, reconnect it at this time. Carefully slide the circuit board down and refasten the two hold down screws located at either end of the circuit board. Be careful not to pinch any wires under the circuit board during this step.

Turn your printer around so that it is facing you and set the front operator control DIP switch as follows:

Position	ON	OFF
1		X
2	X	
3		X
4		X
5		X
6		X
7		X

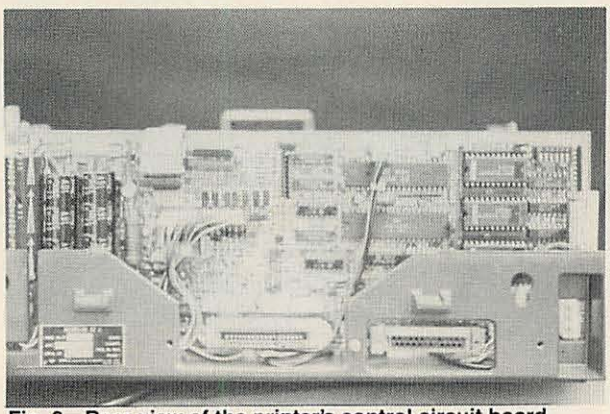

Fig. 3—Rear view of the printer's control circuit board visible when the upper cover has been removed.

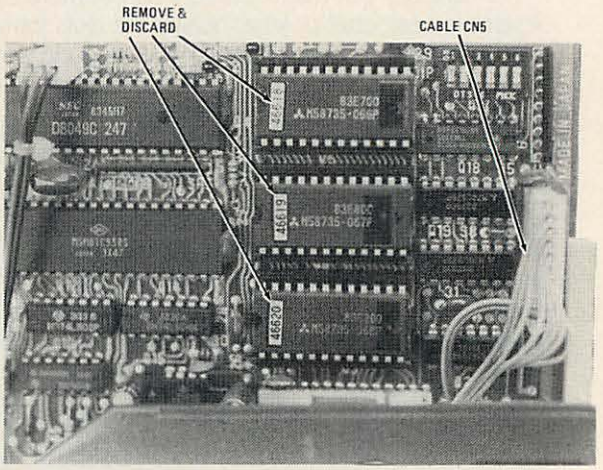

Fig. 4—Detail view of the ROM's (3) and the cable CN5. The 3 ROM ICs are removed and discarded, the cable CN5 may require disconnection.

If you wish, you may refer to Section 4 or Appendix C of the manual which comes with your PC-Writer to select other conditions, however, the conditions selected as shown above (2 on, all others off) are the recommended power-on conditions.

Replace the upper cover by reversing the process used to remove it. Hook the cover at the rear panel and seat it, ensuring that the wire paper guide is flipped forward. Using the Phillips screwdriver tighten the two recessed hold down screws. Replace the access cover and replace the platen knob previously removed. You have now completed the installation of the PC-Writer. The protective foam may be used to store the 3 ROMs removed from the printer. Proceed to the following section and test your installation.

Testing

Load your printer with paper. Plug the printer into the AC wall outlet. Press and hold the line feed button while you turn the power switch on. Release the LINE FEED button and your printer will begin to print the one page document/type sample. This one page will be repeated until you depress the SEL button or turn the printer OFF.

In case of problems

If the printer does not operate immediately and begin the self-test printout, turn the power off, disconnect the AC power cord and recheck all of the installation steps.

Exploring your new PC-Writer

Now that you have installed the module, the normal control functions of the Okidata Printer (See Figure 7) have been enhanced and have additional functions which will be described at this time.

LINE FEED BUTTON-With the printer deselected (RED LED SEL is OFF), pressing the button for more than one second causes the line feeding paper motion to repeat until the button is released. This can make it easier to move the paper over a short distance to the next top-of-form. It can also be used in conjunction with the TOF (top-of-form) button to advance the paper upwards by small amounts. Holding the TOF SET button down and gently pressing the LINE FEED button continuously will advance the paper, when you reach the desired position, relax the LINE FEED button and the new top of form will be set.

SEL (Select) BUTTON-Each time this button is pressed the print head will move to a new position. When the printer is first selected the print head will move to the left margin to recalibrate for proper printing. When you deselect the printer by pressing the button and the RED LED is off, the print head will move to the center to permit you to install the paper without the need to manually move the print head. It is also possible to put the printer ON-LINE after starting a form feed action even though the paper is still moving. Briefly press and release the SEL button and the SEL LED will come on as soon as the paper has stopped moving.

FORM LENGTH ROTARY SWITCH-This switch now has several new functions. If you are using the 132 col. 83A, switch setting 6 now selects a page length of 8½ inches rather than the 8 inch page length shown in the printer manual and repeated on the 83A's access cover. This will allow you to use paper 11 inches wide by 8½ inches high. The other uses of this rotary switch will be covered under the "Feature Selection" category.

Now that you have installed your PC-Writer, your Okidata Printer will provide full emulation of the IBM Graphics printer and more. How much more will depend on what you elect to set by using escape sequences described in detail in the PC-Writer manual (Section 6.2), how you make use of the front panel Features Selection which will be described in detail and your own specific requirements.

The default setting you made earlier on the DIP switch located on the form of the operator control panel enables the selection of all of the enhanced functions. If you desire to use only those functions used or supported by the IBM graphics printer, and no more, you would set switch 5 to ON and 1 and 8 to OFF, and not use any of the unique escape sequences for the PC-Writer. A description of some of the possible settings can be found in Section 4 and 6 of your PC-Writer's manual. For the present, let's leave the switch as

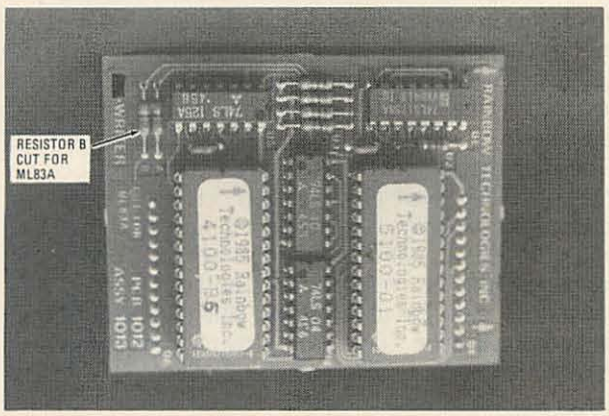

Fig. 5—The PC WRITER Module with call out for location of Resistor B. This resistor is not used with the wide carriage ML 83A printer.

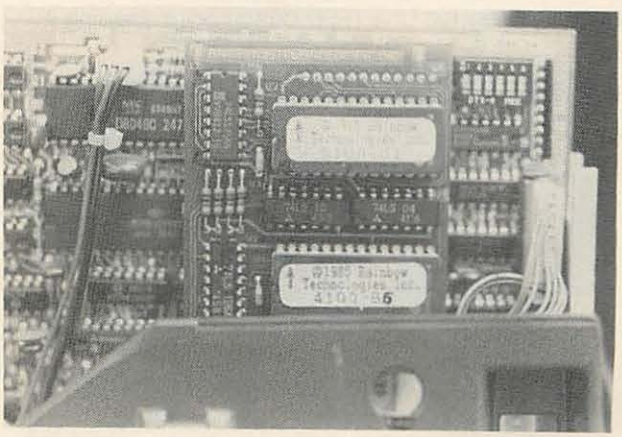

Fig. 6—The PC WRITER Module installed on the control circuit board.

set previously, and enjoy as much of the ease-of selection and feature as possible.

Feature selection

The PC-Writer's features can be accessed in two ways. The first is via traditional computer control mode, this will require that you use the escape sequences unique to your PC-Writer and for the present, we suggest that you confine yourself to the second mode, the user of the now enhanced Front Panel Selection Mode which will allow you access to the most desirable features without the need to program or refer to charts or tables.

FRONT PANEL SELECTION MODE-In this mode, you will use the SEL button, the LINE FEED button and the FORM FEED button and the FORM LENGTH rotary switch. Each of these controls and their function will be explained separately.

Selecting a feature

To convert the front panel control to feature selection, depress the SEL button for one or more seconds to activate the front panel selection mode. This is indicated by an audible tone and the SEL LED flashing at a rate of about 2 or 3 times per second.

To select a feature rotate the FORM LENGTH switch from its normal forms length setting to the desire setting as listed below:

Setting#	Feature Selected
0	Print HELP Menu
1	Letter quality
2	Elite character pitch
3	Compressed character mode
4	Wide characters
5	Shortened characters at 12 lines per inch (1pi)
6	Emphasized printing (bold faced)
7	Double Strike printing
8	Dumb terminal mode
9	Print shifting alphabet test

If position 1 through 8 is selected the SEL LED will indicate if that feature in ON (selected) or OFF. If the feature is ON the SEL LED will be ON more than it is off, if the feature selected is OFF, the LED will be OFF more than it is on. To change the setting or state of the selection, press the LINE FEED button once. Pressing it again will change the selected feature to its opposite setting (off becomes ON, or on becomes OFF). If the FORM LENGTH switch is at the 0 position, pressing the line feed button will print a list (menu) of the features available from PC-Writer and their status (ON or OFF). Position 9 if selected will immediately begin to print a shifting alphabet test as shown in Table 3. To stop this test, press the SEL button.

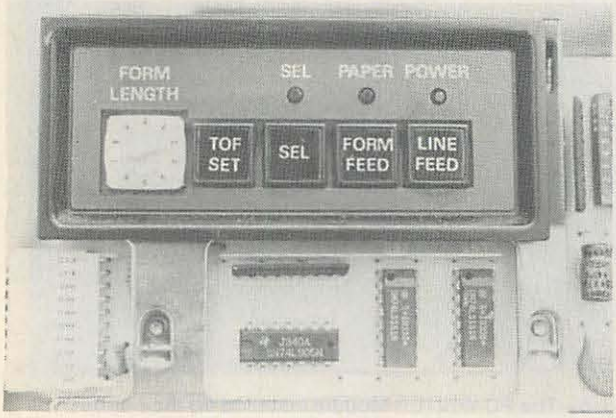

Fig. 7—Detail view of the front panel controls. All controls now have enhanced functions under the PC WRITER.

Draft quality is selected whenever letter quality is not selected. The compressed mode has no effect while the Elite character pitch is selected. Pica character pitch of 10 cpi is selected whenever neither elite or compressed mode is selected. Turning off the shortened character mode (Position 5) will also select 6 LPI spacing. In the dumb terminal mode, all control codes except Carriage Return (CR), Line Feed (LF) and Form Feed (FF) are ignored.

You can also print out the part numbers of the PROMs installed in the module. This information could be helpful whenever you need to discuss either a problem or performance with a factory representative. To print these parts numbers, press the TOF SET and FORM FEED buttons simultaneously.

Once you have selected the desired features, briefly press the SEL button. The LED lamp will go off and an audible tone will sound to indicate that the normal off line (deselected) mode is in effect. Return the FORMS LENGTH switch to its normal forms length setting and press the SEL button again to place the printer ON-LINE. The printer will now be ready to print using the selected PC-Writer Feature.

While the normal functions of the operator front panel controls are well described and documented in your printer manual, using PC-Writer you can also make power-on selections of these features by pressing and holding the button while turning the printer power on. The buttons and their Power-On features are as follows: Operator Button Feature Activated TOP SET Compressed character pitch in draft mode FORM FEEDPica character pitch in letter quality mode SELElectronically reverses the operator DIP SW Pos 8 for ON/OFF or OFF/ON, allows both a serial and parallel cable to be connected to the printer (DO NOT USE WITH HI-SPEED SERIAL CARD!) LINE FEEDSelf-test and demonstration mode. FROM & LINE FEEDDiagnostic Hex dump mode

All features can be deactivated by depressing (deselecting) the SEL button once or when you turn off the printer.

There are many more things you can do with PC-Writer, but if they were all described here, Rainbow Technologies wouldn't have to print a manual. The manual that comes with PC-Writer has sections on code information which is well structured and complete enough to enable you to really take charge of your new printer and exploit it to the limit, after all that's one of the best reasons for buying an enhancement in the first place.

For more information about PC-Writer and any of Rainbow Technologies other products write to them at: Rainbow Technologies Inc., 17971-E Skypark Circle, Irvine, CA 92714. (714) 261-0228.◀CD▶